

## **A discussion of the upper limit of human longevity based on study of data for oldest old survivors and deaths in Japan**

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In the field of biology, theories of aging are roughly divided into two major groups. One is consisting of damage theories and the other is consisting of program theories. According to damage theories we age because our systems break down over time. Meanwhile, in the program theories, it is considered that we age because there is an inbuilt mechanism that tells us to die. If the damage theories are true, we can survive any longer by avoiding damaging our organism. If the program theories are true, on the other hand, we cannot survive longer than the upper limit of longevity with any effort. In this study, for discussing that either the damage theories (there exist a upper limit of human longevity) or the programing theories (there does not exist such a limit) is true, data for oldest old survivors and deaths given by age and birth-period in Japan is analyzed using the extreme value theory and the extinct cohort method. From the results of fitting the binomial regression model with probabilities calculated from the generalized Pareto distribution to the data, the upper limit of human longevity is estimated from 107 to 128 years for male or from 119 to 159 years based on the data for survivors, while that is estimated infinite for some cohorts or from 108 to 262 years for male or from 117 to 165 years for female based on the data for deaths.

Key words: Age-by-period data, extreme value theory, generalized Pareto distribution